

## INLAND NAVIGATION.

## STAGE OF WATER IN RIVERS.

The following table shows the danger-points at the various river stations; the highest and lowest stages for the month, with the dates of occurrence; and the monthly ranges:

*Heights of rivers above low-water mark, July, 1893.*

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Height.	Date.	Height.	Date.	
<i>Red River.</i>	<i>Feet.</i>	<i>Feet.</i>		<i>Feet.</i>		<i>Feet.</i>
Shreveport, La.	29.2	13.9	1	2.8	22	11.1
<i>Arkansas River.</i>						
Fort Smith, Ark.	22.0					
Little Rock, Ark.	23.0	16.7	5	5.3	31	11.4
<i>Missouri River.</i>						
Fort Buford, N. Dak.	25.0	13.8	1-4	10.6	31	3.2
Bismarck, N. Dak.	75.0	8.9	1	5.2	30, 31	3.7
Pierre, S. Dak.	13.0					
Sioux City, Iowa	18.7	12.9	1	9.6	31	3.3
Omaha, Nebr.	18.0	12.5	1	9.0	31	6.5
Kansas City, Mo.	21.0	17.7	5	11.4	27, 31	6.3
<i>Mississippi River.</i>						
Saint Paul, Minn.	14.0	4.2	1	2.3	30	1.9
La Crosse, Wis.	10.0	4.5	1	3.0	31	1.5
Dubuque, Iowa.	16.0	6.6	16-17	4.6	31	2.0
Davenport, Iowa.	15.0	4.3	1	2.5	31	1.8
Keokuk, Iowa.	14.0	5.5	1	2.7	30, 31	2.8
Hannibal, Mo.	17.0	6.7	1	3.5	31	3.2
Saint Louis, Mo.	30.0	21.5	8	9.8	31	11.7
Cairo, Ill.	40.0	22.7	1	11.3	31	11.4
Memphis, Tenn.	33.0	17.7	2	8.9	31	8.8

## Heights of rivers—Continued.

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Height.	Date.	Height.	Date.	
<i>Mississippi River—Continued.</i>	<i>Feet.</i>	<i>Feet.</i>		<i>Feet.</i>		<i>Feet.</i>
Vicksburg, Miss.	41.0	41.4	1	15.0	31	26.4
New Orleans, La.	13.0	16.9	1	7.4	31	9.5
<i>Ohio River.</i>						
Parkersburg, W. Va.	38.0	7.8	2	2.1	29	5.7
Cincinnati, Ohio	45.0	11.4	6	6.1	31	5.3
Louisville, Ky.	24.0	5.7	8, 9	3.4	22-24	2.3
<i>Cumberland River.</i>						
Nashville, Tenn.	40.0	5.3	4	2.6	22	3.7
<i>Tennessee River.</i>						
Chattanooga, Tenn.	33.0	5.5	25	2.6	30, 31	2.9
Knoxville, Tenn.	29.0					
<i>Monongahela River.</i>						
Pittsburg, Pa.	22.0	7.0	4	5.5	24, 26	1.5
<i>Savannah River.</i>						
Augusta, Ga.	32.6	13.3	23	5.2	15, 16	8.1
<i>Willamette River.</i>						
Portland, Oregon	15.0	17.9	1	13.2	31	4.7
<i>Susquehanna River.</i>						
Harrisburg, Pa.	17.0	2.3	1	0.9	30, 31	1.4
<i>Alabama River.</i>						
Montgomery, Ala.	48.0	3.4	1	1.3	26, 27	2.1
<i>James River.</i>						
Lynchburg, Va.	18.0	2.0	4	0.0	27-31	2.0
<i>Sacramento River.</i>						
Red Bluff, Cal.	22.0	2.2	1, 2	1.6	27-31	0.6
Sacramento, Cal.	25.0	19.0	1	12.1	31	6.9
<i>Des Moines River.</i>						
Des Moines, Iowa	19.0	4.4	6, 8	3.4	29-31	1.0

## ATMOSPHERIC ELECTRICITY.

## AURORAS.

A remarkable auroral display was observed from New England to the Pacific coast north of the 40th parallel, and in the central valleys as far south as Tennessee the night of the 15-16th. Prominent features of this display are given in the following table:

*Auroral displays of August 15-16, 1893.*

Date.	Station.	Extent of display.		Remarks.
		Azimuth.	Altitude.	
15	Buffalo, N. Y.	158 to 195	15	Occasional waves at extreme w. end.
15-16	Oswego, N. Y.	155 to 295	5 s. of zenith.	Arch, with flashes 45° s. of zenith. Corona formed sw. of zenith.
15	Rochester, N. Y.			White light, with several small streamers.
15	Lexington, Ky.	158 to 210		Beams of white, with movement from e. to w.
15	Chicago, Ill.	In north.		Hugh beams, with a rapid rolling movement from e. to w.
15	Galva, Ill.			White, soft light, with streamer in nw.
15	Riley, Ill.			Brilliant streamers with a movement from e. to w.
15	Alpena, Mich.	90 to 255	Zenith.	Band of diffused light, resembling the tail of a comet, with a white light at times in all parts of the sky.
15	Detroit, Mich.	135 to 180		White light; 3 parallel beams.
15	Grand Haven, Mich.	135 to 270	25	"Merry dancers" at zenith, moving rapidly from e. to w.
15-16	Manistee, Mich.	150 to 240	30	Arch to zenith moving slowly s. to 10° s. of zenith, with streamers.
15	Marquette, Mich.	90 to 270	Zenith.	White light, with beams to zenith.
15	Olivet, Mich.	110 to 245	Zenith.	Waves of light, with streamers to zenith.
15	Sault Ste. Marie, Mich.	135 to 270	10 s. of zenith.	Waves of light in folds like a curtain.
15-16	Green Bay, Wis.		40	Arch, with luminous beams to 80°.
15-16	Delavan, Wis.			Brilliant streamers; bright spots at zenith.
15	La Crosse, Wis.		10 s. of Zenith.	Arch with streamers; "merry dancers."
15-16	Milwaukee, Wis.	90 to 135	50	Brilliant streamers in continual motion.
15-16	Shawano, Wis.	100 to 270	Zenith.	Arch of white light.

## Auroral displays—Continued.

Date.	Station.	Extent of display.		Remarks.
		Azimuth.	Altitude.	
15-16	Duluth, Minn.	Cov'd 100	65	Beams of rapidly changing colors exhibiting all the hues of a rainbow covered sky.
15-16	Minneapolis, Minn.	135 to 270	10	Curtain-like arch, with bright flashes of light nearly to zenith.
15	Red Wing, Minn.	In north.		Flashes of light at intervals; band of white clouds near zenith, with a wave-like movement from e. to w.
15	Saint Cloud, Minn.			Arch, with streamers and waves of light.
15-16	Saint Paul, Minn.	90 to 270	35	Arch, with many beams; streamers, and broadbands having a tremulous motion.
15-16	Alta, Iowa			Beams of greenish-white light from nw. to beyond zenith. Many colored streamers in n.
15	Keokuk, Iowa.		40	Faint white beams.
15-16	Sioux City, Iowa	132 to 180	80	Beams of white light moved slowly westward and formed one beautiful beam.
15-16	Bismarck, N. Dak.	170 to 270	Zenith.	Bright streamers, with a waving motion.
15	Forman, N. Dak.		46 s. of zenith.	Corona with wave-like movement from e. to w. in s. and a display in n. independent of coronas in s.
15-16	Fort Buford, N. Dak.	Cov'd sky	Zenith.	Flashes and streamers of yellowish-white light from all parts of the horizon to zenith.
15-16	Yankton, S. Dak.	110 to 275	60	Pale light with many beams.
15-16	Rapid City, S. Dak.	130 to 220	30	Arch, beams to zenith, having a lateral movement toward the e.
15	Huron, S. Dak.	105 to 275	80	Arch, having a wave-like motion.
15	Agee, Nebr.	90 to 270	65	Arch, with streamers nearly to zenith.
15	Kearney, Nebr.	165 to 255	70	Arch, with straw-colored crescent and streamers.
16	Havre, Mont.	Cov'd sky	80 s. of zenith.	Began 12.20 a. m. Sky filled with beams to a point s. of zenith, forming a corona. Flashes of light to 10° of s. horizon.
15	Miles City, Mont.		30	Arch, with "merry dancers" to 65°.
15-16	Winnemucca, Nev.	160 to 225	35	Bright yellow light with streamers of red.
15	Salt Lake City, Utah	In north.		A glow in n., with occasional streamers to 45°.
16	Portland, Oregon			Display from 2.10 to 2.50 a. m., with faint streamers in nw.
15-16	Eureka, Cal.	170 to 200	22	Streamers of reddish light.

## THUNDERSTORMS.

Description of the more severe thunderstorms reported for the month is given under "Local storms."

Thunderstorms were reported as follows: East of the Rocky Mountains they were reported in the greatest number of states, 38, on the 8th; in 35 on the 15th and 26th; in 34 on the 3d and 17th; in 32 on the 1st, 5th, and 6th; in 31 on the 2d, 16th, and 25th; in 20 to 30 on the 4th, 7th, 9th, 10th, 12th, 13th, 14th, 18th, 19th, 22d, and 27th to 31st; and in 10 to 19 on the 11th, 20th, 21st, 23d, and 24th. There were no dates on which thunderstorms were reported in less than 10 states.

East of the Rocky Mountains thunderstorms were reported on the greatest number of dates, 31, in Florida and Louisiana; on 20 to 30 in Alabama, Arkansas, Georgia, Illinois, Iowa, Kansas, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New York, North Carolina, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, and West Virginia;

on 10 to 19 in Connecticut, Delaware, Indiana, Kentucky, Maine, Maryland, Massachusetts, Montana, New Hampshire, New Jersey, North Dakota, Ohio, Vermont, and Wisconsin; on 9 in Oklahoma and Rhode Island; on 8 in the District of Columbia; and on 2 in Indian Territory.

West of the Rocky Mountains thunderstorms were reported in Arizona on the 2d to 7th, 9th, 11th to 24th, and 28th to 31st; in California on the 10th, 12th, 16th, 19th, 20th, 21st, 23d, 24th, and 25th; in Colorado on the 1st, 2d, 3d, 5th to 14th, and 17th to 31st; in Idaho on the 8th, 20th, 22d, 26th, 27th, 28th, and 31st; in Nevada on the 19th to 28th; in New Mexico on the 2d, 3d, 7th to 13th, 15th to 18th, 21st, 26th, 28th, 29th, and 31st; in Oregon on the 2d, 10th, 21st, 26th, 28th, 30th, and 31st; in Utah on the 9th, 10th, 11th, 13th, 15th, 19th to 28th, and 31st; in Washington on the 2d, 8th, 9th, 13th, 15th, 21st, 22d, 29th, 30th, and 31st; and in Wyoming on the 4th, 5th, 6th, 11th, 13th, 14th, 21st, 22d, 23d, and 25th to 28th.

## STATE WEATHER SERVICES.

[Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.]

The following extracts and summaries are republished from reports for July, 1893, of the directors of the various state weather services:

## ALABAMA.

**Temperature.**—The mean was 0.2 below the normal; maximum, 103, at Newburg, 28th; minimum, 60, at Brewton, 18th; greatest monthly range, 42, at Brewton; least monthly range, 22, at Livingston and Pushmataha.

**Precipitation.**—The average was nearly 1.00 below the normal; greatest monthly, 12.22, at Healing Springs; least monthly, 1.10, at Claiborne.

**Wind.**—Prevailing direction, southwest.—*W. M. Dudley, Observer, Weather Bureau, Montgomery, director.*

## ARIZONA.

**Temperature.**—Maximum, 118, at Buckeye, 30th; minimum, 42, at Whipple Barracks, 1st; greatest monthly range, 56, at Buckeye; least monthly range, 33, at Saint Helenas Ranch.

**Precipitation.**—Greatest monthly, 6.47, at Wilgus; least monthly, 0.50, at Yuma.

**Wind.**—Prevailing direction, southwest.—*W. Burrows, Observer, Weather Bureau, Tucson, director.*

## ARKANSAS.

**Temperature.**—The mean was 0.5 above the normal; maximum, 103, at Hot Springs, 28th; minimum, 59, at Marshall, 19th; greatest monthly range, 43, at Hot Springs; least monthly range, 26, at Greenville, Miss.

**Precipitation.**—The average was 1.12 below the normal; greatest monthly, 7.81, at Rogers; least monthly, 0.51, at Ozark.

**Wind.**—Prevailing direction, south.—*F. H. Clarke, Local Forecast Official, Weather Bureau, Little Rock, director.*

## CALIFORNIA.

**Temperature.**—The mean was 2.0 below the normal; maximum, 122, at Volcano Springs, 10th; minimum, 30, at Cisco, 11th; greatest monthly range, 72, at San Ardo; least monthly range, 11, at Poway.

**Precipitation.**—The average was 0.02 above the normal; greatest monthly, 1.65, at Julian; least monthly, 0.00, at a number of stations.

**Wind.**—Prevailing direction, west.—*J. A. Barwick, Observer, Weather Bureau, Sacramento, director.*

## COLORADO.

**Temperature.**—The mean was 1.0 above the normal; maximum, 105, at Minneapolis, 6th; minimum, 28, at Breckenridge, 17th.

**Precipitation.**—The average was about 0.27 below the normal; greatest monthly, 9.50, at River Bend; least monthly, 0.11, at Grand Junction.

**Wind.**—Prevailing direction, west.—*J. J. Gilligan, Observer, Weather Bureau, Denver, director.*

## FLORIDA.

**Temperature.**—The mean was about 1.0 above the normal; maximum, 101, at Mullet Key, 18th, and at Bristol, 26th; minimum, 63, at Green Cove Springs, 14th; greatest monthly range, 35, at Plant City; least monthly range, 18, at Key West.

**Precipitation.**—The average was about 3.00 below the normal; greatest monthly, 12.56, at Oxford; least monthly, 1.20, at Mullet Key.

**Wind.**—Prevailing direction, southeast.—*E. R. Demain, Observer, Weather Bureau, Jacksonville, director.*

## GEORGIA.

**Temperature.**—Maximum, 108, at Cordele, 25th; minimum, 52, at Dia-

mond, 13th; greatest monthly range, 49, at Griffin; least monthly range, 18, at Hephzibah.

**Precipitation.**—Greatest monthly, 8.21, at Darien; least monthly, 0.86, at Newman.

**Wind.**—Prevailing direction, west.—*Park Morrill, Local Forecast Official, Weather Bureau, Atlanta, director.*

## IDAHO.

**Temperature.**—Maximum, 104, at Payette, 20th; minimum, 22, at Bonanza City, 7th; greatest monthly range, 71, at Bonanza City; least monthly range, 47, at Kootenai.

**Precipitation.**—Greatest monthly, 0.94, at Bonanza City; least monthly, trace, at Idaho Falls.

**Wind.**—Prevailing direction, southwest.—*J. H. Smith, Observer, Weather Bureau, Idaho Falls, director.*

## ILLINOIS.

**Temperature.**—The mean was 2.0 above the normal; maximum, 102, at McLeansboro, 13th, and at Rantoul, 14th; minimum, 49, at Dixon, 3d.

**Precipitation.**—The average was 1.26 below the normal; greatest monthly, 4.86, at Oregon; least monthly, trace, at Kankakee.

**Wind.**—Prevailing direction, southwest.—*John Craig, Observer, Weather Bureau, Springfield, director.*

## INDIANA.

**Temperature.**—The mean was 3.3 above the normal; maximum, 100, at Angola, 13th; minimum, 45, at Columbia City, 4th; greatest monthly range, 50, at Columbia City and Delphi; least monthly range, 24, at Columbus.

**Precipitation.**—The average was 1.30 below the normal; greatest monthly, 4.77, at Mount Vernon; least monthly, 0.03, at Logansport.

**Wind.**—Prevailing direction, southwest.—*Prof. H. A. Huston, Lafayette, director; C. F. R. Wappenhans, Local Forecast Official, Weather Bureau, assistant.*

## IOWA WEATHER AND CROP SERVICE.

**Temperature.**—The mean was 1.5 above the normal; maximum, 102, at Ames (near), 13th, and at Atlantic, 14th; minimum, 47, at Atlantic, 3d, and at Sibley, 8th; greatest monthly range, 55, at Atlantic; least monthly range, 27, at Maquoketa.

**Precipitation.**—The average was slightly below the normal; greatest monthly, 8.84, at Clarinda; least monthly, 1.49, at Oskaloosa.—*J. R. Sage, Des Moines, director; G. M. Chappel, Local Forecast Official, Weather Bureau, assistant.*

## KANSAS.

**Temperature.**—The mean was 0.8 above the normal; maximum, 110, at Kiowa, 30th; minimum, 47, at Washington, 7th; greatest monthly range, 56, at Minneapolis; least monthly range, 31, at Lawrence.

**Precipitation.**—The average was 0.42 above the normal; greatest monthly, 9.28, at Oberlin; least monthly, 0.37, at Grenola.

**Wind.**—Prevailing direction, south.—*T. B. Jennings, Observer, Weather Bureau, Topeka, director.*

## KENTUCKY.

**Temperature.**—The mean was normal; maximum, 101, at Harrodsburg, 24th, and at Princeton, 28th; minimum, 50, at Louisa, 28th; greatest monthly range, 49, at Louisa.